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10/662,316	09/16/2003	Chan Young Park	K-0541	1791

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EXAMINER	
CHANG, AUDREY Y	
ART UNIT	**PAPER NUMBER**
2872	

DATE MAILED: 03/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/662,316	PARK, CHAN YOUNG
	Examiner	Art Unit
	Audrey Y. Chang	2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 January 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *16-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *16-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 September 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Remark

- This Office Action is in response to applicant's amendment filed on January 21, 2005, which has been entered into the file.
- By this amendment, the applicant has canceled claims 1-15 and has newly added claims 16-44.
- Claims 16-44 remain pending in this application.

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, "a *plurality* of cladding layers and respective core layers" recited in claim 43 and "the plurality of core layers are arranged substantially parallel to the first or second set of electrodes" recited in claims 29 and 44 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be

notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. **Claims 16-44 are rejected under 35 U.S.C. 112, first paragraph**, as based on a disclosure which is not enabling. The *conditions* of having the refractive index of the liquid crystal holographic optical element to be **greater** than the refractive index of the waveguide **and** the light incident on the liquid crystal holographic optical element must be *greater* than a *critical angle* in order for the light to be reflected back to the optical waveguide *via total internal reflection* are critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). A liquid crystal holographic optical element will not be able to reflect the light back to the waveguide *via total internal reflection* by itself. The conditions set forth above are the *necessary criterions* for the total internal reflection to occur. Furthermore, the claims fail to provide *how* does the hologram of the liquid crystal holographic optical element is *switched* or "selectively *adjustable*" in order for the light to be *reflected back* to the optical waveguide via total internal reflection. The liquid crystal holographic optical element **cannot** cause total internal reflection of the light. Rather the liquid crystal holographic optical element is being switched to have a uniform refractive index, (i.e. no hologram formed in this state), wherein the refractive index is being greater than the refractive index of the waveguide and the when the light incident on the hologram is greater than a critical angle, which is determined by refractive indices of both the liquid crystal material and the

waveguide, then the total internal reflection can occur at the interface. Total internal reflection means the light does not travel to the liquid crystal holographic optical element at all. The claims also fail to teach how does the hologram is adjusted to have at least some of the input light to be transmitted through the liquid crystal holographic optical element. The liquid crystal material has to be adjusted to form refractive index bands, or grating structure with alternative refractive indices in alternative regions, therefore forms a hologram, wherein the refractive indices of the liquid crystal holographic optical element and incident angle of the light do not satisfy the total internal reflection criterions so that the light enters the holographic optical element and is diffracted by the element.

4. **Claims 22 and 37 are rejected under 35 U.S.C. 112, first paragraph**, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification and the claims fail to teach how could a hologram is capable being adapted to diffract red, green and blue light. A single hologram can only diffract one particular wavelength of the light, this is due the very nature of a hologram.

Claim Objections

5. **Claims 17, 19-22, 24, 27-28, 31, 32, 34-37, 42-44 are objected to because of the following informalities:**

(1). The phrases "pixel areas" and "sub-pixels areas" recited in claims 17, 19 and 32 and 34 are confusing and indefinite since it is not clear what are considered to be the pixel and sub-pixel areas and in particular it is not clear how do these pixel areas and sub-pixel areas relate to the liquid crystal holographic optical element. The phrase "sub-pixels areas comprise red, green and blue sub-pixel areas"

recited in claims 21 and 36 is confusing and indefinite since it is not clear what are considered to be the "*red*, *green* and *blue* sub-pixel areas"? The claims fail to teach how could these sub-pixel areas be red, green or blue.

(2). The phrase "the first set of electrodes" recited in claim 16 is confusing and indefinite since it lacks antecedent basis from earlier part of the claim. The first and second set of electrodes recited in claims 17, 18 and the phrase "the first and second set of electrodes" recited in claims 29 and 43 are confusing and indefinite since they each lacks proper antecedent basis from their respective based claim. It is also not clear how does the first set of electrodes recited in different claims relate to each other.

(3). The phrase "through the selected area *if* the liquid crystal holographic optical element" recited in claim 24 is totally confusing.

(4). The phrase "an area that is substantially the same as an effective display area" recited in claims 27 and 42, is confusing and indefinite since the "effective display area" is not defined so it is not clear how could "an area" be the "same" as an undefined area.

(5). The phrase "a plurality of light guiding cores" recited in claims 28 and 42 and the phrase "the plurality of light guiding cores are arranged substantially parallel to the first or second set of the electrodes" recited in claims 29 and 43 are confusing and indefinite since it is not clear how does this "plurality of light guiding cores" relate to the liquid crystal holographic optical element.

(6). The phrase "an index of refraction of the liquid crystal holographic optical element in the first state is substantially the same as the index of refraction of the at least one cladding layer" recited in claim 31 is confusing and indefinite since it is not clear how does this feature has anything to do with the device. There lacks logical relationship to make the scope of the claim clear.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 16-20, and 24-27 are rejected under 35 U.S.C. 102(e) as being anticipated by Natarajan et al (PN. 6,821,457).

Natarajan et al teaches a *device* that is comprised of an *optical waveguide* (i.e. the optical contact *substrate* illustrated in Figures 20-26) for receiving and guiding an *input* light, and *a liquid crystal holographic optical element*, having a plurality of *output* holographic optical elements (HOE) each serves as the holograms. Natarajan et al teaches that each of the holographic optical elements (HOE) comprises a *hologram* (18, Figure 1) recorded in a *liquid crystal material* (12) and the liquid crystal material is interposed between *two transparent electrodes*, (14, Figure 1). The plurality of output holographic optical elements, (please see Figure 26), therefore together serves as the *liquid crystal holographic optical element*. It is implicitly true and as demonstrated by the Figures 1 and 20-25, one of the electrodes for the HOE is positioned on the optical waveguide. Natarajan et al teaches that the electrodes are adapted to *selectively* apply a voltage across the hologram of the holographic optical element such that the hologram is selectively adjustable between a *first state* of having all of the incident light *reflects* back to the optical waveguide (Figures 24 and 25), and at least one other state wherein at least some of the incident light *transmits* through the holographic optical element, (Figures 23 and 25). Natarajan et al teaches explicitly that the input light is directed into the waveguide in such a manner that the light strikes the boundaries of the waveguide at an angle greater than critical angle of the substrate or the waveguide so that the incident light is basically trapped within the waveguide by *total internal reflection*, (TIR). When the holographic

optical element or the hologram is at first state, no diffraction or any "fan-out" occurs for the incident light, the light therefore is reflected back to the waveguide via total internal reflection, (please see column 18, lines 24-65). The holographic optical element or the hologram can also be adjusted to at least an other state such that diffraction occurs and some of the light will be diffracted out of the waveguide or transmitted through the waveguide, (please see Figures 19-26, columns 17-20).

With regard to claims 17-20, Natarajan et al teaches that a plurality of the output holographic optical elements can be positioned on the waveguide, (please see Figure 26), wherein each of the elements has a liquid crystal hologram interposed between a first and a second electrode, such that the *plurality* of first and second electrodes together severs as the first set and the second set of electrodes respectively. Each of the liquid crystal holograms can be *selectively* switched by *applying* the voltage across the liquid crystal hologram via the first and second electrodes. Each of the holographic optical elements can be identified as the sub-pixel and a set of the sub-pixels can be identified as the pixels.

With regard to claim 24-25, Natarajan et al teaches that the voltage across the holographic optical elements (HOE) can be adjusted such that all of the light is transmitted through the element and the percentage of the input light being transmitted through the element is controlled by the value of the voltage across the element, (please see column 19, lines 35-62).

With regard to claims 26, it is implicitly true that there is a light source for generating the input light.

With regard to claim 27, the substrate waveguide, (Figures 20-26), serves as the light guiding core and has an area that can be identified as effective display area.

This reference has therefore anticipated the claims.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. **Claims 21-23, and 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Natarajan et al .**

The optical device taught by Natarajan et al as described for claim 16 above has met all the limitations of the claims.

With regard to claims 21-22, Natarajan et al does not teach explicitly that the sub-pixels are of red, green or blue sub-pixels and does not each explicitly that the holograms are designed to diffract red, green or blue light respectively. However it is very well known in the art to record the hologram to diffract either red, green or blue light for such modifications only involve using either red, green or blue light as the recording light. It would have been obvious to one skilled in the art to make the individual output holographic optical element to either diffract red, green or blue light for the benefit of making the device to provide full color light output so that the optical device can be applied in full color illumination applications.

With regard to claim 23, Natarajan et al teaches that the other state that the holographic optical element is capable of diffracting light is achieved by having a finite voltage across the liquid crystal hologram, (please see Figure 2), but it does not teach explicitly that the first state where no diffraction occurs is achieved by having no voltage across, however such modification really does not change the outcome function of the liquid crystal holographic optical element as explicitly stated above and therefore is not considered as a novel difference rather it is a design choice to one skilled in the art for the benefit of

using different voltage settings to achieve the same effect so that is may be suitable for different application requirement.

With regard to claims 28 and 29, this reference does not teach explicitly that the optical waveguide comprises a plurality of light guiding cores. However it would have been obvious to one skilled in the art to combine a plurality of the waveguide with the output holographic optical elements disposed upon it (such as Figure 26) for the benefit of making a two-dimensional optical interconnect that is capable of input and fan-out input light in a two-dimensional extended surface that allows a two-dimensional illumination pattern be generated. In other word to extend the rather one-dimensional waveguide interconnect into a two-dimensional waveguide interconnect.

10. Claims 30-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Natarajan et al in view of the patent issued to Pawluczyk (PN. 5,518,863).

Natarajan et al teaches a *device* that is comprised of an *optical waveguide* (i.e. the optical contact *substrate* illustrated in Figures 20-26), serves as the *core* layer for receiving and guiding an *input* light, and *a liquid crystal holographic optical element*, having a plurality of *output* holographic optical elements (HOE) each serves as the holograms. Natarajan et al teaches that each of the holographic optical element (HOE) comprises a *hologram* (18, Figure 1) recorded in a *liquid crystal material* (12) and the liquid crystal material is interposed between *two transparent electrodes*, (14, Figure 1). The plurality of output holographic optical elements, (please see Figure 26), therefore together serves as the *liquid crystal holographic optical element*. It is implicitly true and as demonstrated by the Figures 1 and 20-25, one of the electrodes for the HOE is positioned on the optical waveguide. Natarajan et al teaches that the electrodes are adapted to *selectively* apply a voltage across the hologram of the holographic optical element such that the hologram is selectively adjustable between a *first state* of having all of the incident light *reflects* back to the optical waveguide (Figures 24 and 25), and at least one other state wherein at

least some of the incident light *transmits* through the holographic optical element, (Figures 23 and 25). Natarajan et al teaches explicitly that the input light is directed into the waveguide in such a manner that the light strikes the boundaries of the waveguide at an angle greater than critical angle of the substrate or the waveguide so that the incident light is basically trapped within the waveguide by *total internal reflection*, (TIR). When the holographic optical element or the hologram is at first state, no diffraction or any "fan-out" occurs for the incident light, the light therefore is reflected back to the waveguide via total internal reflection, (please see column 18, lines 24-65). The holographic optical element or the hologram can also be adjusted to at least an other state such that diffraction occurs and some of the light will be diffracted out of the waveguide or transmitted through the waveguide, (please see Figures 19-26, columns 17-20).

This reference has met all the limitations of the claims with the exception that it does not teach explicitly that the waveguide or the core layer is on a cladding layer. However one skilled in the art would understand that it is a standard design for waveguide to have a core layer formed on a cladding layer, as explicitly shown by the teachings of **Pawluczyk**, wherein a core layer (20, Figure) is formed on a cladding layer (22) so that total internal reflection of the light within the core layer is ensured, (please see Figure 1, column 6, lines 28-35). It would then have been obvious to modify the waveguide or core layer of Natarajan et al to form it on a cladding layer for the benefit of ensuring the incident light is properly propagated within the core layer via total internal reflection.

With regard to claim 31, the cited references do not teach such feature explicitly however since the claim fails to establish the relevancy of this feature to properly define the metes and bounds of the claim, such feature cannot be examined here. However it is implicitly true that the refractive index of the output holographic optical element in **compared** with the *core layer* satisfies the requirement for allowing total internal reflection of the light to occur at the interface of the element and the core layer.

With regard to claims 32-35, Natarajan et al teaches that a plurality of the output holographic optical elements can be positioned on the waveguide, (please see Figure 26), wherein each of the elements has a liquid crystal hologram interposed between a first and a second electrode, such that the *plurality* of first and second electrodes together severs as the first set and the second set of electrodes respectively. Each of the liquid crystal holograms can be *selectively* switched by *applying* the voltage across the liquid crystal hologram via the first and second electrodes. Each of the holographic optical elements can be identified as the sub-pixel and a set of the sub-pixels can be identified as the pixels.

With regard to claims 36-37, Natarajan et al does not teach explicitly that the sub-pixels are of red, green or blue sub-pixels and does not each explicitly that the holograms are designed to diffract red, green or blue light respectively. However it is very well known in the art to record the hologram to diffract either red, green or blue light for such modifications only involve using either red, green or blue light as the recording light. It would have been obvious to one skilled in the art to make the individual output holographic optical element to either diffract red, green or blue light for the benefit of making the device to provide full color light output so that the optical device can be applied in full color illumination applications.

With regard to claim 38, Natarajan et al teaches that the other state that the holographic optical element is capable of diffracting light is achieved by having a finite voltage across the liquid crystal hologram, (please see Figure 2), but it does not teach explicitly that the first state where no diffraction occurs is achieved by having no voltage across, however such modification really does not change the outcome function of the liquid crystal holographic optical element as explicitly stated above and therefore is not considered as a novel difference rather it is a design choice to one skilled in the art for the benefit of using different voltage settings to achieve the same effect so that is may be suitable for different application requirement.

With regard to claim 39-40, Natarajan et al teaches that the voltage across the holographic optical elements (HOE) can be adjusted such that all of the light is transmitted through the element and the percentage of the input light being transmitted through the element is controlled by the value of the voltage across the element, (please see column 19, lines 35-62).

With regard to claims 41, it is implicitly true that there is a light source for generating the input light.

With regard to claim 42, the substrate waveguide, (Figures 20-26), serves as the light guiding core and has an area that can be identified as effective display area.

With regard to claims 43-44, this reference does not teach explicitly that the optical waveguide comprises a plurality of light guiding cores. However it would have been obvious to one skilled in the art to combine a plurality of the waveguide with the output holographic optical elements disposed upon it (such as Figure 26) for the benefit of making a two-dimensional optical interconnect that is capable of input and fan-out input light in a two-dimensional extended surface that allows a two-dimensional illumination pattern be generated. In other word to extend the rather one-dimensional waveguide interconnect into a two-dimensional waveguide interconnect.

Response to Arguments

11. Applicant's arguments with respect to **newly submitted** claims 16-44 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (8:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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